Laboratory-Campus NP Connections

I. Recent history of NP on campus

II. Science and personnel connections

III. New initiative opportunities

Office of Science
U.S. DEPARTMENT OF ENERGY

BERKELEY LAB

History

Early days of the lab, NSD's connections were to nuclear chemistry
- most of these connections were lost as NP and chemistry evolved in different directions

Years of DOE committee recommendations to re-establish campus connections - students, collaborative lab/campus research

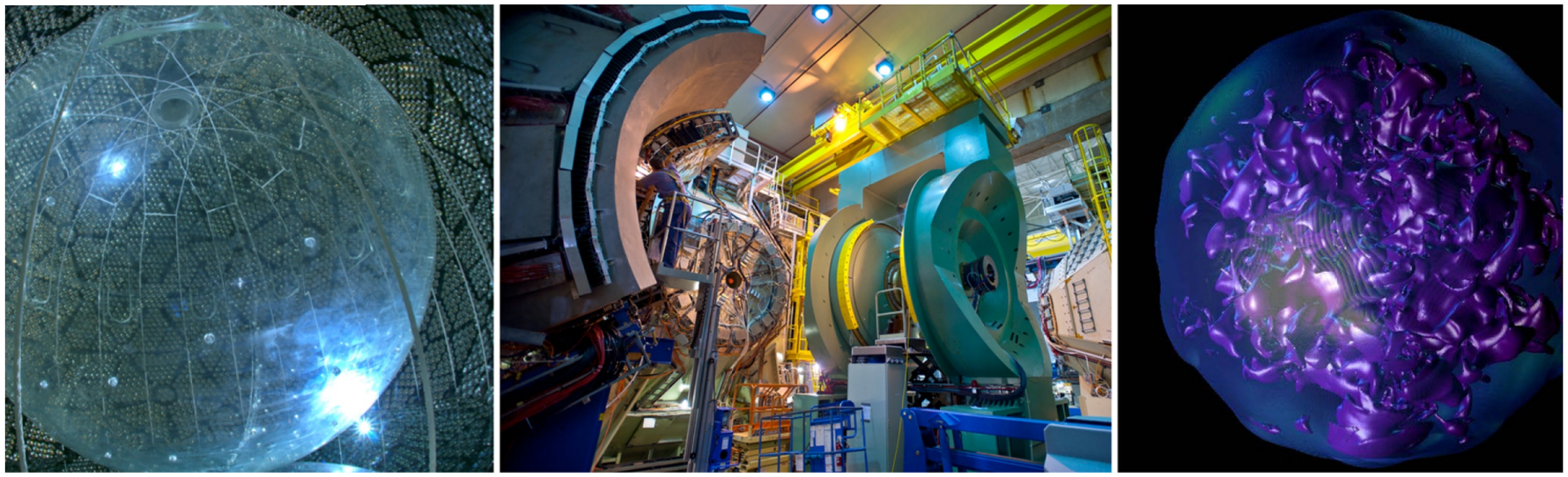
There were multiple efforts and one success (Freedman, 1991)

The Nuclear Science Division renewed the rebuilding effort in 2008: initiated by NSD Theory Group, continued with experimental hires
- Haxton hired in 2009
- Kasen in 2011
- Orebi-Gann (experimentalist - double beta decay) in 2012
- Jacak in 2015

All have joint appointments

NP became an official Department group in 2015
- recognition helpful in attracting entering students

Physics
@BERKELEY



NUCLEAR PHYSICS

UC Berkeley nuclear physics faculty work on low-energy neutrino physics, including solar and supernova neutrinos; nuclear astrophysics, including the origin of the elements and the nuclear physics of dark matter direct and indirect detection; studies of ultra-relativistic heavy ion collisions, to probe the properties of strongly interacting matter at extreme energy densities; electroweak interactions, including tests of symmetries using neutrinoless double beta decay and electric dipole moments; and various aspects of many-body physics. We are closely connected to and affiliated with our sister groups in Astrophysics and Particle Physics.

The group members work closely with Lawrence Berkeley Laboratory, especially the Nuclear Science Division. Our research is carried out at a variety of locations and within several national collaborations. These include the Canadian deep underground laboratory SNOLab and the Relativistic Heavy Ion Collider (RHIC) at Brookhaven. Major collaborations include the double beta decay experiment SNO+, the Phenix and sPhenix detectors at RHIC, the SciDAC (Scientific Discovery through Advanced Computing) collaboration CaliforniaLattice (CalLat), the UC MultiCampus Research Initiative on Dark Matter, the dark matter search experiment DEAP, the UC Research Program on Frontiers of Neutrino Physics and Nuclear Astrophysics, and the Department of Energy Topical Collaboration on Neutrinos and Nucleosynthesis in Hot and Dense Matter.

PHYSICS FACULTY

THEORISTS

NSD

Wick Haxton

Dan Kasen

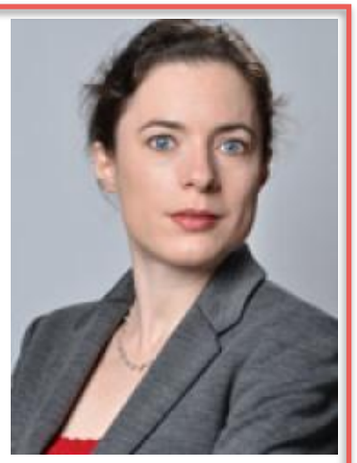
EXPERIMENTALISTS

NSD

Steven Boggs

Astro - NuSTAR
SSL

Barbara Jacak



Gabriel Orebi Gann

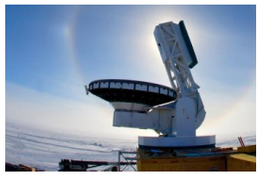
Matt C Pyle

Astro/Part CDMS

NSD

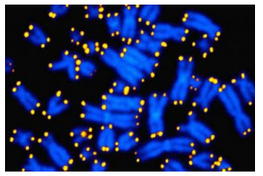
Yury Kolomensky

Berkeley Group Structure

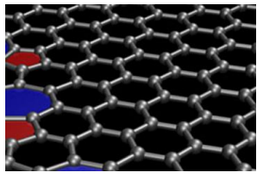


ASTROPHYSICS

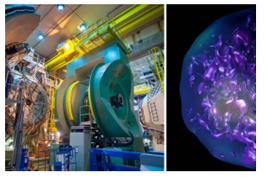
ATOMIC, MOLECULAR AN...



BIOPHYSICS

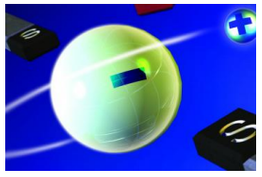


CONDENSED MATTER PH...



NUCLEAR PHYSICS

PARTICLE PHYSICS



PLASMA AND NONLINEA...

EMERITUS FACULTY

<u>The LBL/campus coupling is unique in the DOE Lab Complex</u>

One of the strongest research universities in the US,
immediately adjacent to a National Lab

Campus/lab coupling helps us in recruiting at all levels:
has been a deciding factor in faculty recruiting

Research start-up packages, quality of computing resources,
and quality of laboratory facilities
all advanced by the campus and lab working together

This has proven a win-win collaboration
for campus and Lab divisions, including now NSD

Connections

Our campus members have been able to establish connections important to the overall NP Berkeley lab/campus effort

- <u>Students:</u> now engage with the students in classroom, research poster sessions, the introduction-to-research class, thesis research, senior honors theses, recruitment

- <u>Group connections:</u> Dan ⇔ Theoretical Astrophysics Center
  Wick ⇔ TAC, Particle Theory
  Barbara, Gabriel, Yury ⇔ Particle Experiment

  Helpful: e.g., TAC recruitment led to our six lab Einstein and Hubble Fellows

- <u>Hosting meetings:</u> TAUP Conference and Summer School, 9/2012
  CUWiP 2014
  EIC Users Meeting 2016
  CIPANP 5/2018
  Simplifies NSF and private funding, some other organizational aspects

- <u>Campus appointments</u>: needed for grant or collaboration reasons, student supervision, etc
  Exceptional PI, Researcher, Visiting Scientist, Visiting Professor

  (EPI status often necessary for grants: Xin-Nian, Andre, Spencer have or will need this)

- <u>To support people important to NSD</u>
  - Huey-Wen Lin (Lattice QCD): APS Blewett Fellowship
  - visiting postdocs from overseas
  - visiting professors: e.g., Frank Calaprice

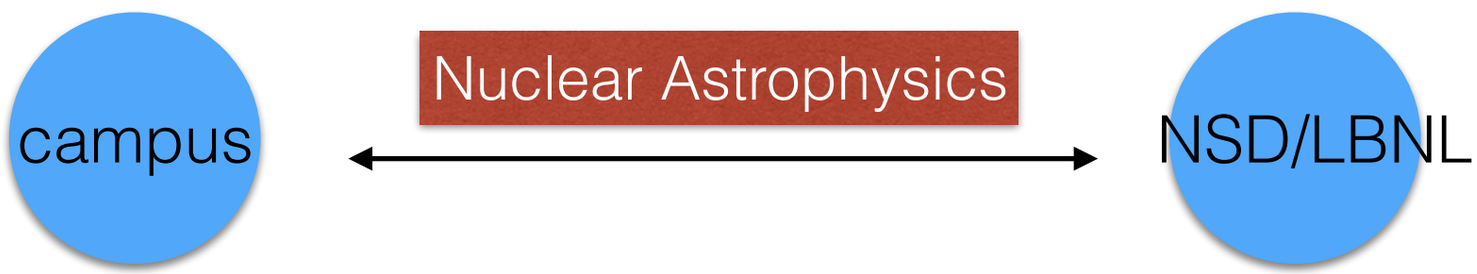
NP student space
open-office arrangement

Campus space

Third-floor of Old LeConte being reorganized to accommodate atomic physics, nuclear physics, and dark matter

WH, BJ: Fourth floor OLC
DK: New Campbell

Shared Science Interests



TAC Recruitment	→	NSD NASA and Hubble Fellows
UCOP Neutrino Astro Grant	→	DK, WH SN nucleosynthesis work
SN survey programs	←	Exascale challenge leadership
Dark matter experiments	⇔	EFT, structure work
Grad and undergrad students	→	SNO+, theory programs
N3AS	→	PDs involve in lab computational astro programs

Shared Science Interests

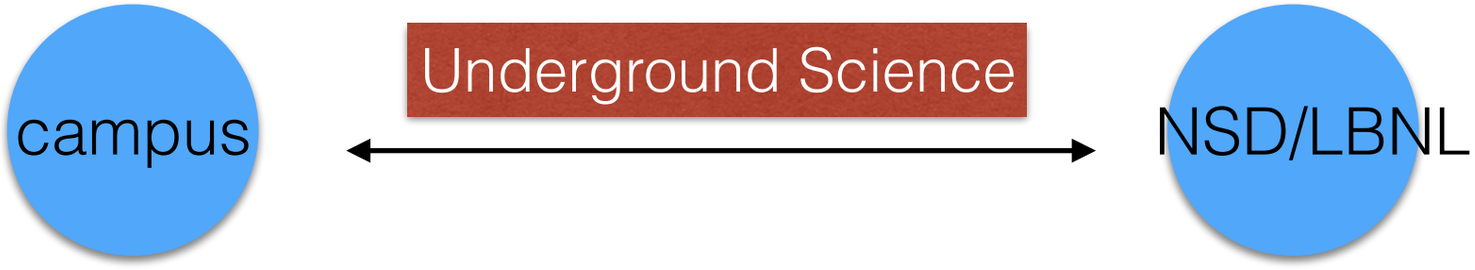
major initiatives include

LBNL NSD-led SciDAC program on LQCD/EFT (with campus, LLNL, Nvidia)

NSD's ECP numerical astro program (effectively TAC's NS, merger, SN effort)

NSD/Physics Division/NERSC collaboration on data-intensive analysis:
ALICE, STAR, double beta decay, KATRIN, LUX, ATLAS
important to nuclear and particle programs on campus and LBNL

Shared Science Interests



initiatives located at Sanford Lab, SNOLab, China, Italy

SuperCDMS and LUX/LZ: G2 dark matter (campus/Physics Division)

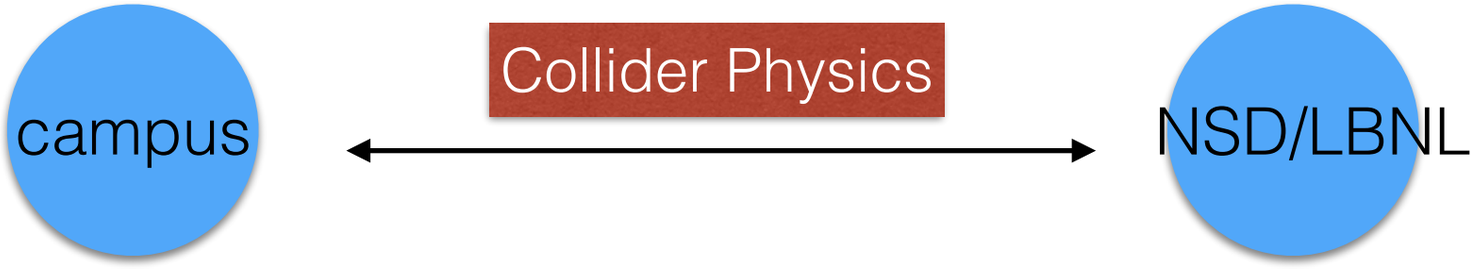
CUORE/Majorana/SNO+/KamLAND (campus/NSD)

low-background counting (NSD/Physics Division)

Continued analysis of SNO (NSD)

Daya Bay, LBNF (campus/Physics Division)

Shared Science Interests



LHC (particle physics and the quark-gluon plasma)

LHC ATLAS physics (campus/Physics Division)

LHC ALICE physics (campus/NSD)

UCOP-supported LBL/NSD-led California Consortium:
EIC detector development

Recruiting

Campus and various international collaborations are our primary student sources

The establishment of a NP Group on campus has enhanced our student visibility

Dan has been particularly active, leading the Departmental grad recruitment effort

International students come from a variety of sources. Examples:

theory: Central China Normal University students collaborating with Xin-Nian

theory: Germany - DAAD-sponsored students

experiment: Elusives Network exchange students

Recruiting

Theory Group postdoctoral program is significantly enhanced through various topical collaboration and computational science initiatives

JET and BEST Topical Collaborations (NSD)

Symmetries/Double Beta Decay Topical Collaboration (campus + NSD)

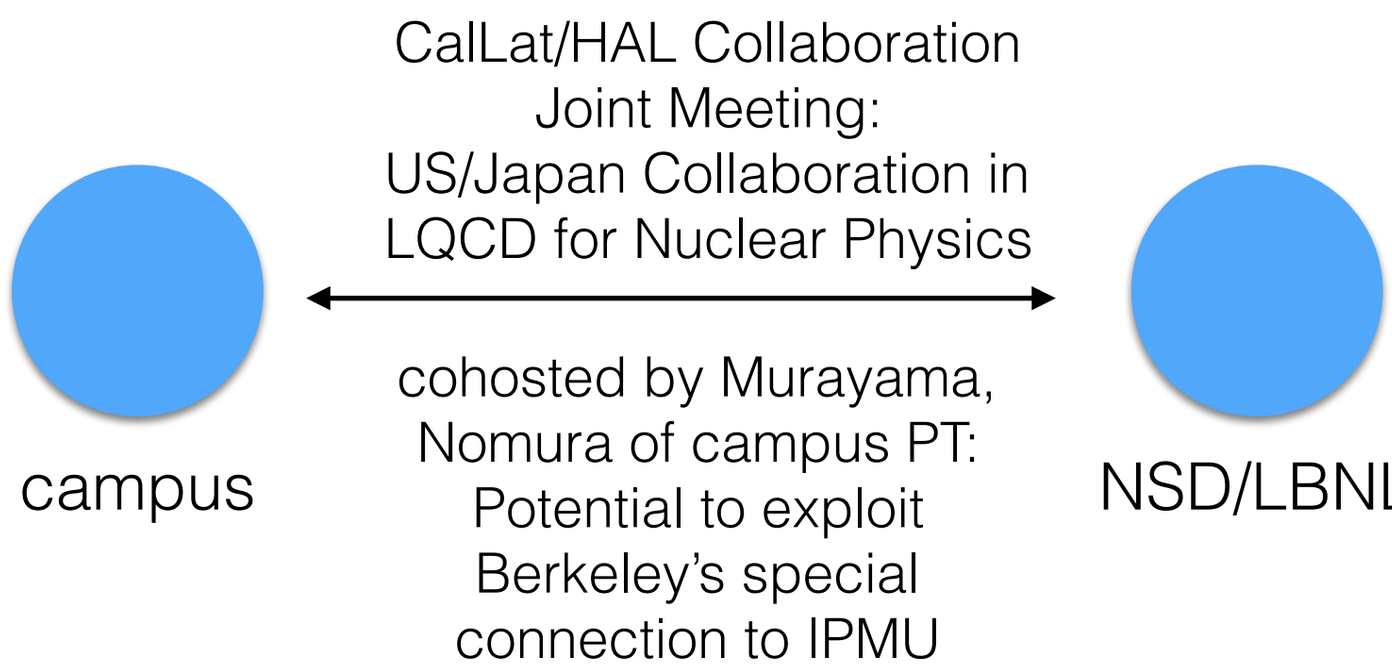
New NSF PD Hub: Network for Neutrinos, Nuclear Astrophysics, and Symmetries (campus)

SciDAC Lattice QCD/EFT Initiative: “Multiscale Nuclear Physics” (NSD/CRD/campus/LLNL)

Exascale Challenge Project “Exascale Models of Stellar Explosions” (NSD/CRD)

The campus/lab theory effort operates as a single group: LBNL the center of most activities

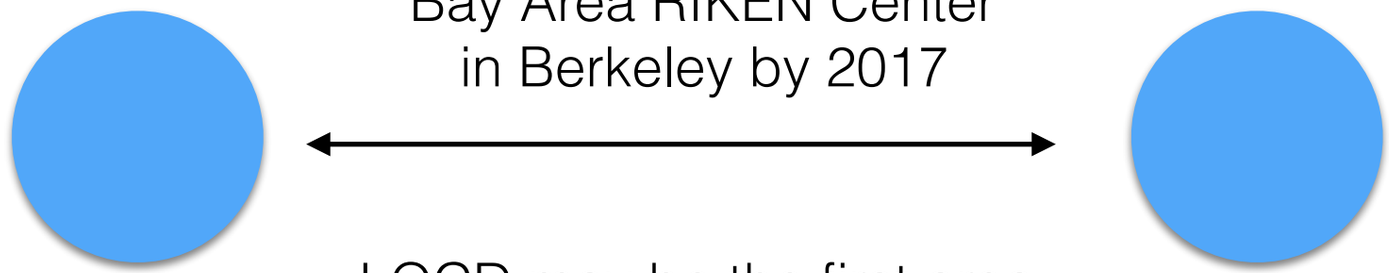
Opportunities on the Horizon (helped by campus partnerships)



NSD/Japanese Collaborations in LQCD

Opportunities on the Horizon

RIKEN's plan to establish a Bay Area RIKEN Center in Berkeley by 2017



campus

NSD/LBNL

LQCD may be the first area of collaboration, but many possibilities in nuclear theory and experiment will likely open up

The re-establishment of campus/NSD ties
is greatly helping the Division:
students, new postdoc programs,
new science opportunities

Noticed on campus, too:
growing appreciating of and support for NP

We will continue to build on this:
theory and experiment